

CLAIMS

1. A system for pumping a cryogenic fluid from a storage tank, said system comprising:

a reciprocating pump comprising a suction inlet and a discharge outlet;
a first pipe fluidly connecting said suction inlet to liquid within the interior of said storage tank;

a second pipe fluidly connecting said suction inlet to vapor within said storage tank; and

a restriction in said second pipe for limiting flow through said second pipe so that a mixture of liquid and vapor may be supplied from said storage tank to said suction inlet.

2. The system of claim 1 wherein said pump comprises a cold end disposed within a sump and a warm end opposite to said cold end and said suction inlet is associated with said cold end and said discharge outlet is associated with said warm end.

3. The system of claim 1 further comprising a linear hydraulic drive connected to a piston of said pump.

4. The system of claim 3 wherein said piston is drivable at a constant speed by said linear hydraulic drive.

5. The system of claim 3 wherein said pump is operable by said linear hydraulic drive at speeds between 5 and 30 cycles per minute.

6. The system of claim 1 wherein said restriction is made by an orifice.

7. The system of claim 1 wherein said restriction is effected by a metering valve.

8. The system of claim 1 wherein said restriction is sized to maintain a vapor fraction supplied to said pump that is equal to or less than a predetermined maximum vapor fraction.

9. The system of claim 1 wherein said reciprocating pump comprises an inducer disposed between said suction inlet a compression chamber.

10. The system of claim 9 further comprising a check valve disposed within said suction inlet to prevent fluid from flowing from said inducer back into said first and second pipes.

11. The system of claim 10 wherein said inducer comprises:
an induction chamber with a volume that is at least four times the volume of said compression chamber;
a piston is reciprocable within said induction chamber, dividing said induction chamber into two subchambers;
a first check valve allowing fluid to flow from a first one of said two subchambers to a second one of said two subchambers; and
a second check valve allowing fluid to flow from said second one of said two subchambers to said first one of said two subchambers.

12. The system of claim 1 wherein said reciprocating pump comprises:
a first compression chamber in fluid communication with said suction inlet;
a second compression chamber in fluid communication with said first compression chamber and said discharge outlet, wherein the volumetric ratio between said first chamber and said second chamber is more than 2:1;
a reciprocable piston disposed within said reciprocating pump and fluidly separating said first and second compression chambers;
a check valve disposed in said suction inlet through which fluid can flow from said first and second pipes into said first compression chamber;

a check valve disposed in a passage between said first and second chamber through which fluid can flow from said first compression chamber to said second compression chamber; and

a check valve associated with said discharge outlet through which fluid can flow from said second compression chamber.